PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Pinyen LIN et al.	Group Art Unit: 2629
Application No.: 09/683,547	Examiner: S. KUMAR
Filed: January 16, 2002	Docket No.: 109128

For: SPACER LAYER FOR ELECTROPHORETIC DISPLAY DEVICE

DECLARATION UNDER 37 C.F.R. §1.131

I, Pinyen Lin, a named inventor in the above-identified application, hereby declare and state:

1. This Declaration is submitted as evidence that the subject matter claimed in Claims 1, 2, 4-9 and 11-27 of the above-identified application was invented by the named inventors prior to March 3, 2000, the U.S. filing date of U.S. Patent No. 6,930,818 (Liang et al.), which invention date is also before the April 7, 2001 filing date of U.S. Patent No. 6,819,316 (Schulz et al.).

2. I am a named co-inventor in the above-identified application.

3. I am an author of the attached six Invention Proposals, all dated prior to March 3, 2000, a true copy of each of which appears as Exhibits A-F attached to this Declaration.

4. In the copies of the Invention Proposals attached hereto as Exhibits A-F, dates and other material that could indicate dates have been masked out as permitted under the U.S. patent rules. Additionally, the employee numbers on page 1 of each Invention Proposal have also been masked out. Finally, each of the Invention Proposals contained four total pages, despite the pages of each Invention Proposal being labeled as "of 5."

5. Exhibit A describes an electrophoretic display device (electronic paper) comprising a spacer layer sandwiched between two conductive film substrates, at least one of which is transparent, the spacer layer defining a multiplicity of individual reservoirs within the display device that are completely separated from each other, each of the individual reservoirs being filled with a display liquid, and wherein the spacer layer is a screen comprised of fibers in which holes within the screen define the individual reservoirs. The screen is particularly described to be comprised of woven fibers that have been flattened and fused at fiber joints. See particularly pages 2-3 and Figures 1-3 of the Invention Proposal of Exhibit A.

6. The invention described in Exhibit A may be summarized as "An electrophoretic display device comprising a spacer layer sandwiched between two conductive film substrates, at least one of which is transparent, the spacer layer defining a multiplicity of individual reservoirs within the display device that are completely separated from each other, each of the individual reservoirs being filled with a display liquid, wherein the spacer layer is selected from the group consisting of (a) a screen comprised of fibers in which holes within the screen define the individual reservoirs, ..." as recited in present claims 6 and 7, and "wherein the screen is comprised of woven fibers, which have been flattened and fused at fiber joints" as recited in present claim 8.

7. Exhibit B describes an electrophoretic display device (electronic paper) comprising a spacer layer sandwiched between two conductive film substrates, at least one of which is transparent, the spacer layer defining a multiplicity of individual reservoirs within the display device that are completely separated from each other, each of the individual reservoirs being filled with a display liquid, wherein the spacer layer is a laser punched spacer layer comprised of a laser ablatable material in a form of a sheet having holes laser punched

therein and in which the laser punched holes define the individual reservoirs. See particularly pages 2-3 and Figures 1-3 of the Invention Proposal of Exhibit B.

8. The invention described in Exhibit B may be summarized as "An electrophoretic display device comprising a spacer layer sandwiched between two conductive film substrates, at least one of which is transparent, the spacer layer defining a multiplicity of individual reservoirs within the display device that are completely separated from each other, each of the individual reservoirs being filled with a display liquid, wherein the spacer layer is selected from the group consisting of ... (b) a laser punched spacer layer comprised of a laser ablatable material in a form of a sheet having holes laser punched therein and in which the laser punched holes define the individual reservoirs..." as recited in present claims 6 and 9.

9. Exhibit C describes an electrophoretic display device (electronic paper) comprising a spacer layer sandwiched between two conductive film substrates, at least one of which is transparent, the spacer layer defining a multiplicity of individual reservoirs within the display device that are completely separated from each other, each of the individual reservoirs being filled with a display liquid, wherein the spacer layer is an etched photoresist layer comprised of a photoresist material, formed upon one of the conductive film substrates, having a plurality of openings etched through the photoresist material, and in which the plurality of openings etched in the photoresist material define the individual reservoirs. See particularly pages 2-3 and Figures 1-4 of the Invention Proposal of Exhibit C.

10. The invention described in Exhibit C may be summarized as "An electrophoretic display device comprising a spacer layer sandwiched between two conductive film substrates, at least one of which is transparent, the spacer layer defining a multiplicity of individual reservoirs within the display device that are completely separated from each other, each of the individual reservoirs being filled with a display liquid, wherein the spacer layer is selected from the group consisting of ... (c) an etched photoresist layer comprised of a

photoresist material, formed upon one of the conductive film substrates, having a plurality of openings etched through the photoresist material, and in which the plurality of openings etched in the photoresist material define the individual reservoirs..." as recited in present claims 6 and 18.

11. Exhibit D describes an electrophoretic display device (electronic paper) comprising a spacer layer sandwiched between two conductive film substrates, at least one of which is transparent, the spacer layer defining a multiplicity of individual reservoirs within the display device that are completely separated from each other, each of the individual reservoirs being filled with a display liquid, wherein the spacer layer is a composite etched layer comprised of a composite of two photoresist layers each comprised of a photoresist material sandwiching a conductive film and in which holes etched through the composite define the individual reservoirs. The conductive film of the composite etched layer is particularly described to be a metal. See particularly pages 2-3 and Figures 1-6 of the Invention Proposal of Exhibit D.

12. The invention described in Exhibit D may be summarized as "An electrophoretic display device comprising a spacer layer sandwiched between two conductive film substrates, at least one of which is transparent, the spacer layer defining a multiplicity of individual reservoirs within the display device that are completely separated from each other, each of the individual reservoirs being filled with a display liquid, wherein the spacer layer is selected from the group consisting of ... (d) a composite etched layer comprised of a composite of two photoresist layers each comprised of a photoresist material sandwiching a conductive film and in which holes etched through the composite define the individual reservoirs" as recited in present claims 6 and 19, and "wherein the conductive film of the composite etched layer is a metal" as recited in present claim 20.

13. Exhibits E and F describe single and multi-color electrophoretic display devices (electronic papers) comprising a spacer layer sandwiched between two conductive film substrates, at least one of which is transparent, the spacer layer defining a multiplicity of individual reservoirs within the display device, each of the individual reservoirs being filled with a display liquid, wherein the spacer layer comprises at least one pocket sheeting layer comprised of at least two sheets joined together and containing a pattern of pockets within the joined sheets, and wherein the pockets define the individual reservoirs. Extensive details on the process of manufacture of the pocket sheeting layer(s) are also set forth. See particularly pages 2-3 and Figures 1-4 of the Invention Proposal of Exhibit E and pages 2-3 and Figures 1-4 of the Invention Proposal of Exhibit F.

14. The invention described in Exhibits E and F thus may be summarized as "An electrophoretic display device comprising a spacer layer sandwiched between two conductive film substrates, at least one of which is transparent, the spacer layer defining a multiplicity of individual reservoirs within the display device, each of the individual reservoirs being filled with a display liquid, wherein the spacer layer comprises at least one pocket sheeting layer comprised of at least two sheets joined together and containing a pattern of pockets within the joined sheets, and wherein the pockets define the individual reservoirs" as recited in present claim 1.

15. Exhibits A-F describe inventions conceived and reduced to practice in the United States prior to March 3, 2000. These inventions are claimed in the above-identified application.

16. Prior to March 3, 2000, I or those under my direct control and supervision, carried out a reduction to practice of the inventions described in Exhibits A-F and thereby provided an electrophoretic display device as described in paragraphs 5-14 herein.

17. I hereby declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine and/or imprisonment under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing therefrom.

Date: 5-25-06

Pinyen LIN

EXHIBIT A

XEROX Invention Proposal

XEROX Private Data

To: Xerox Intellectual Property Department

IP

[X] Xerox Square - 020A, Rochester, NY, 14644, Mail Stop XRX2-20A

[ ] El Segundo, CA, 101 Continental Blvd.. 90245, Mail Stop: ESC1-801

[ ] Palo Alto, CA, 3333 Coyote Hill Road 94304, Mail Stop: PARC

Annette Bolc

(Send Original to the Intellectual Property Department and a copy to your Manager.)

	Proposal Submitted By (Please use legal name) Full First Name, Middle, Last		Employee No.	
1	Pinyen Lin SAM			
	Organization (Unit/Div/Dept/Section)	Electronic Mail Address	Bldg. No./Mail Stop	Extension
	CSS/SD&MS/TDD&M	Pinyen_Lin@wb.xerox.com	W139-65B	8*225-7382
	Proposal Submitted By (Please use legal name) Full First Name, Middle, Last		Employee No.	
2	David H. Pan MME			
	Organization (Unit/Div/Dept/Section)	Electronic Mail Address	Bldg. No./Mail Stop	Extension
	XR&T/WCR&T	Dpan@crt.xerox.com	W114-23D	8*222-8969
	Proposal Submitted By (Please use legal name) Full First Name, Middle, Last		Employee No.	
3	Chieh-Min Cheng			
	Organization (Unit/Div/Dept/Section)	Electronic Mail Address	Bldg. No./Mail Stop	Extension
	CSS/SD&MS/TDD&M	Chieh-min.Cheng@sdms.usa.xerox.com	W143-02S	8*222-6094
	Proposal Submitted By (Please use legal name) Full First Name, Middle, Last		Employee No.	
*4	Adam Bush (contract)			
	Organization (Unit/Div/Dept/Section)	Electronic Mail Address	Bldg. No./Mail Stop	Extension
	CSS/SD&MS/TSS	Adam.Bush@usa.xerox.com	W139-64A	8*225-5633

*** If space for additional submitters is required, please use another sheet ; and attach any supplementary Comments.**

Mangers	Electronic Mail Address
Daniel G. Marsh (139-65B) / Kathy O'Brien (143-02S) / Santokh Badesha (114-39A)	Daniel.Marsh@usa.xerox.com

Descriptive Title of Proposal:

Flattened Screen Spacer Layer in Electronic Paper Application

Provide a brief summary or abstract of the invention, specifically pointing out the feature that you think is new:

This Invention Proposal suggests a thin film device (electronic page) with a flattened screen spacer layer that can display an image under an electric field using LID, CEP, and lithography technology.

Provide here, using added pages, a more detailed technical description of your invention, including the advantage(s), and the problem(s) solved by the invention, and how each is accomplished. Please indicate the current methods or techniques used to solve the problem(s), and the deficiencies of these methods or techniques. Sketches, drawings, notebook pages, memos, or photos can be very helpful and should be attached if possible:

More than 120 CEOs and other corporate executives all over the world went to Seattle for Microsoft's annual CEO Summit meeting. In the keynote speech, Microsoft CEO Bill Gates outlined his vision for how business leaders can use the Digital Nervous System. One of the things Gates mentioned was the E-book. "It will probably be 5 to 10 years before we have the screens that have the right weight and the right resolution before that happens. But, the key point is, that it is going to happen." Gates said.

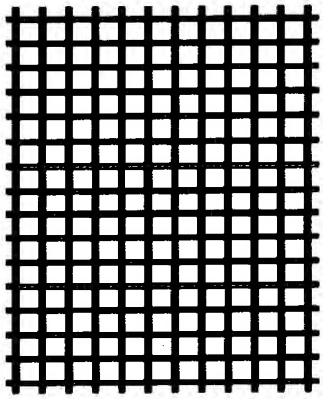
Approach

As mentioned in the previous IP/ , the electronic paper design can be achieved using LID (Liquid Ink Development) and CEP (Contact Electrostatic Printing) technology. LID is charged liquid toner dispersed in hydrocarbon fluid such as Isopar. The toner concentration is around 2% and the toner is developed under electrical field of about 1 volt per micron gap. The idea is to prepare a liquid toner containing two types of toner particles with opposite charge and visual contrast color.

Witnessed and Understood By	Date
Submitter(s) Signature(s)	Date

One material that can be used for the electronic paper spacer layer is screen (figure 1). With a sufficient enough mesh size and a small enough fiber diameter, screen can be used to house the liquid toner and still provide adequate resolution when an image is developed. Due to the woven nature of screen however, with overlapping fibers, individual sealed wells are not present. Where one fiber overlaps another, liquid from one well can flow into another well, defeating the purpose of the spacer layer. Therefore, the screen must first be flattened and the fiber joints must be fused to create individual liquid toner wells, before it can be used as a spacer layer. This can be accomplished under a hot press using appropriate conditions for the given fiber material.

Figure 1. Screen to be Used for Electronic Paper Spacer Layer



As shown in Figure 2, the liquid toner can be placed or printed into the reservoirs, which are the 50-200 micron spaces between screen fibers, and then glued down to the substrate. The substrate is a transparent, conductive plastic film, such as PET coated with indium tin oxide (ITO). Finally, sealing the top with another conductive PET film completes the multi-layered electronic paper design.

Figure 2 shows that the top surface appears white since all colored toner particles are hidden behind the white particles. Figure 3 shows the colored liquid toner moves to the top surface, and thus the color image appears. The conductive path on the bottom substrate can be patterned so that the electric field on each reservoir can be controlled individually.

Witnessed and Understood By	Date
Submitter(s) Signature(s)	Date

Figure 2. The film under positive electrical field (off position)

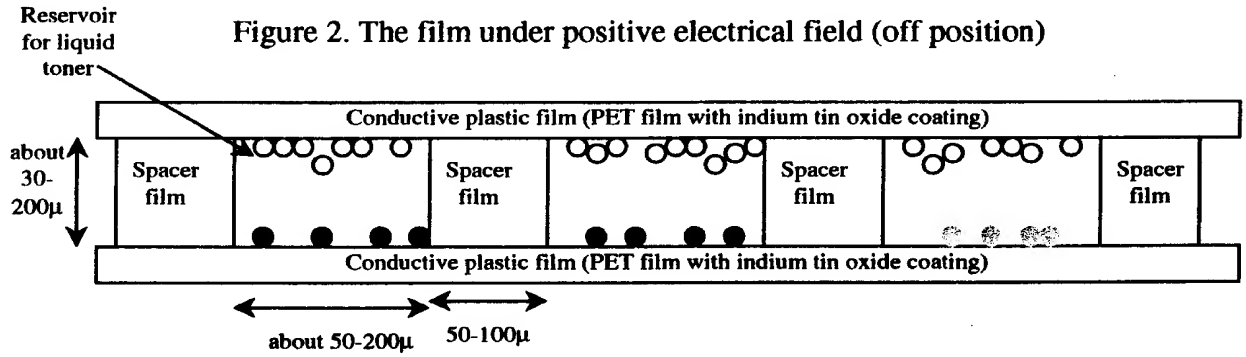
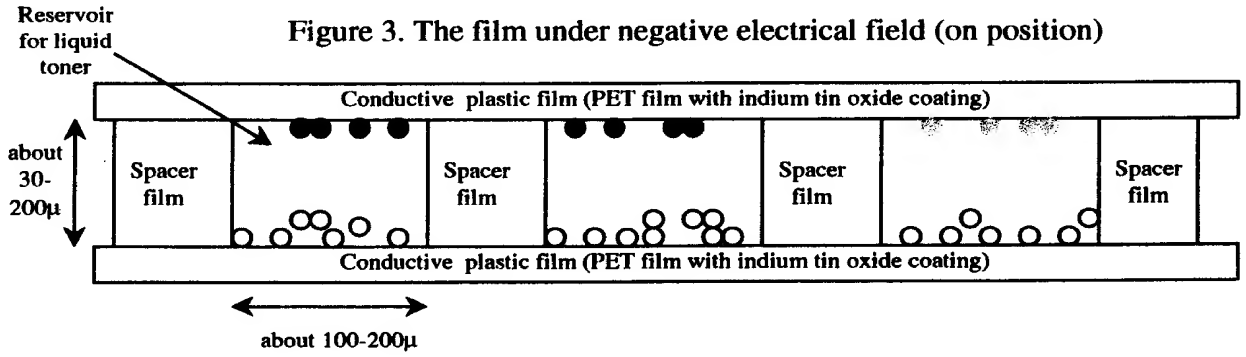


Figure 3. The film under negative electrical field (on position)



Witnessed and Understood By	Date
Submitter(s) Signature(s)	Date

Names of others known to have worked on this or similar invention:
Not Known

Identify any known similar, or related invention proposals, patents or publications. Xerox or non-Xerox commercial products, or indicate none: :

Has a model, a prototype, or experiment of the invention been built, made, run, or tested?	Yes	No	X
Is the invention used in a current product(s) or planned for use in a future product(s)?	Yes	No	

If so, please identify the program(s) or product(s), and introduction dates

Indicate the date(s) of any previous or planned future disclosure external to Xerox, (has the invention been disclosed, or is it planned or disclosure outside of Xerox) and identify the type of disclosures (by agreement, demonstration, paper or presentation given, market probe, published article, etc. and if convenient , please provide a copy of the agreement, paper or article):
No

Source of outside funding, if any:
NONE

Witnessed and Understood By	Date
Submitter(s) Signature(s)	Date

EXHIBIT B

XEROX Invention Proposal

XEROX Private Data

To: Xerox Intellectual Property Department

IP

[X] Xerox Square - 020A, Rochester, NY, 14644, Mail Stop XRX2-20A

[ ] El Segundo, CA, 101 Continental Blvd.. 90245, Mail Stop: ESC1-801

[ ] Palo Alto, CA, 3333 Coyote Hill Road 94304, Mail Stop: PARC

(Send Original to the Intellectual Property Department and a copy to your Manager.)

	Proposal Submitted By (Please use legal name) Full First Name, Middle, Last	Electronic Mail Address	Employee No. / Bldg. No./Mail Stop	Extension
1	Pinyen Lin			
	Organization (Unit/Div/Dept/Section) CSS/SD&MS/TDD&M	Pinyen_Lin@wb.xerox.com	W139-65B	8*225-7382
2	David H. Pan			
	Organization (Unit/Div/Dept/Section) XR&T/WCR&T	Dpan@crt.xerox.com	W114-23D	8*222-8969
3	Chieh-Min Cheng			
	Organization (Unit/Div/Dept/Section) CSS/SD&MS/TDD&M	Chieh-min.Cheng@sdms.usa.xerox.com	W143-02S	8*222-6094
*4	Adam Bush (contract)			
	Organization (Unit/Div/Dept/Section) CSS/SD&MS/TSS	Adam.Bush@usa.xerox.com	W139-64A	8*225-5633

*** If space for additional submitters is required, please use another sheet ; and attach any supplementary Comments.**

Mangers: Daniel G. Marsh (139-65B), Kathy O'Brien (143-02S), Santokh Badesha (114-39A) — Electronic Mail Address: Daniel.Marsh@usa.xerox.com

Descriptive Title of Proposal:

Laser Punched Porous Spacer Layer in Electronic Paper Application

Provide a brief summary or abstract of the invention, specifically pointing out the feature that you think is new:

This Invention Proposal suggests a thin film device (electronic page) with a Laser punched porous spacer layer that can display an image under an electric field using LID, CEP, and lithography technology.

Provide here, using added pages, a more detailed technical description of your invention, including the advantage(s), and the problem(s) solved by the invention, and how each is accomplished. Please indicate the current methods or techniques used to solve the problem(s), and the deficiencies of these methods or techniques. Sketches, drawings, notebook pages, memos, or photos can be very helpful and should be attached if possible:

More than 120 CEOs and other corporate executives all over the world went to Seattle for Microsoft's annual CEO Summit meeting. In the keynote speech, Microsoft CEO Bill Gates outlined his vision for how business leaders can use the Digital Nervous System. One of the things Gates mentioned was the E-book. "It will probably be 5 to 10 years before we have the screens that have the right weight and the right resolution before that happens. But, the key point is, that it is going to happen." Gates said.

Approach

As mentioned in the previous IP/ , the electronic paper design can be achieved using LID (Liquid Ink Development) and CEP (Contact Electrostatic Printing) technology. LID is charged liquid toner dispersed in hydrocarbon fluid such as Isopar. The toner concentration is around 2% and the toner is developed under electrical field of about 1 volt per micron gap. The idea is to prepare a liquid toner containing two types of toner particles with opposite charge and visual contrast color.

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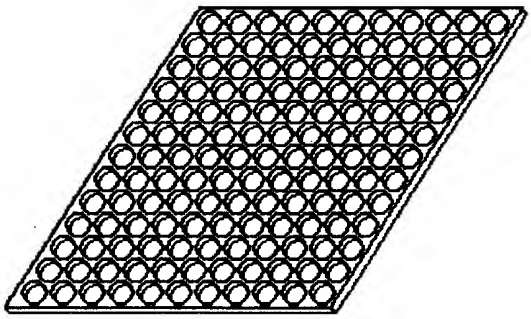
One method for achieving a spacer layer with a hole size, shape, and spacing that will best suit the electronic paper design is to use a laser to punch the holes through the film. The desired hole diameter, shape, and spacing pattern can be programmed into the computer for which to guide the laser. The result is a PET film spacer layer that meets exact specifications.

Figure 1. PET Film With Laser Holes Punched Through.



As shown in Figure 2, the liquid toner can be placed or printed into the reservoirs, which are 50-200 micron holes in the spacer film, and then glued down to the substrate. The substrate is a transparent, conductive plastic film, such as PET coated with indium tin oxide (ITO). Finally, sealing the top with another conductive PET film completes the multi-layered electronic paper design.

Figure 2 shows that the top surface appears white since all colored toner particles are hidden behind the white particles. Figure 3 shows the colored liquid toner moves to the top surface, and thus the color image appears. The conductive path on the bottom substrate can be patterned so that the electric field on each reservoir can be controlled individually.

Witnessed and Understood By	Date
Submitter(s) Signature(s)	Date

Figure 2. The film under positive electrical field (off position)

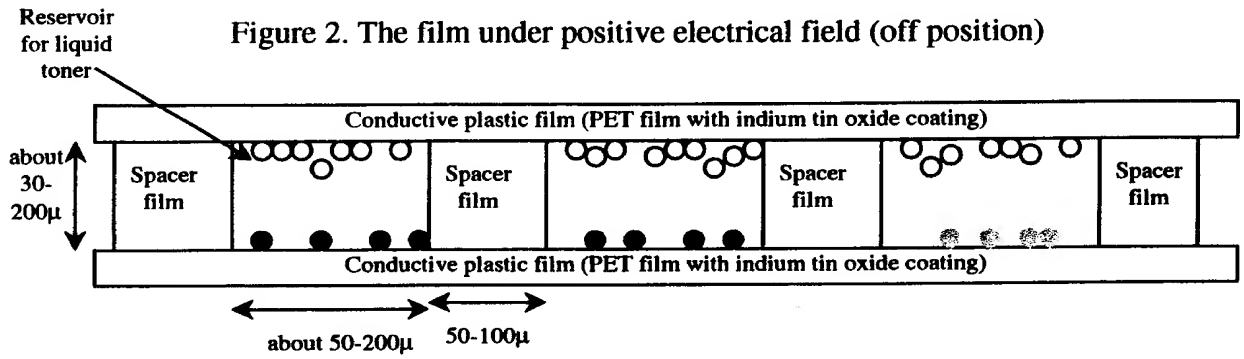
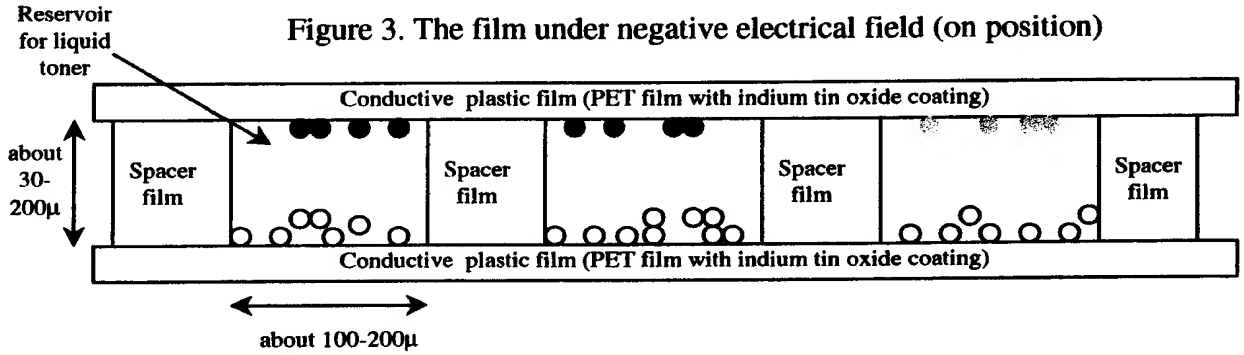


Figure 3. The film under negative electrical field (on position)



Witnessed and Understood By	Date
Submitter(s) Signature(s)	Date

Names of others known to have worked on this or similar invention:
Not Known

Identify any known similar, or related invention proposals, patents or publications. Xerox or non-Xerox commercial products, or indicate none: :

Has a model, a prototype, or experiment of the invention been built, made, run, or tested?	**Yes**	**No** X
Is the invention used in a current product(s) or planned for use in a future product(s)?	**Yes**	**No**

If so, please identify the program(s) or product(s), and introduction dates

Indicate the date(s) of any previous or planned future disclosure external to Xerox, (has the invention been disclosed, or is it planned or disclosure outside of Xerox) and identify the type of disclosures (by agreement, demonstration, paper or presentation given, market probe, published article, etc. and if convenient , please provide a copy of the agreement, paper or article):
No

Source of outside funding, if any:
NONE

Witnessed and Understood By Paula Berlandt	Date
Submitter(s) Signature(s) David Pan Ping Li	Date

EXHIBIT C

XEROX Invention Proposal

XEROX Private Data

To: Xerox Intellectual Property Department

[X] Xerox Square - 020A, Rochester, NY, 14644, Mail Stop XRX2-20A

[ ] El Segundo, CA, 101 Continental Blvd.. 90245, Mail Stop: ESC1-801

[ ] Palo Alto, CA, 3333 Coyote Hill Road 94304, Mail Stop: PARC

(Send Original to the Intellectual Property Department and a copy to your Manager.)

1	Proposal Submitted By (Please use legal name) Full First Name, Middle, Last Pinyen Lin		Employee No.	
	Organization (Unit/Div/Dept/Section) CSS/SD&MS/TDD&M	Electronic Mail Address Pinyen_Lin@wb.xerox.com	Bldg. No./Mail Stop W139-65B	Extension 8*225-7382
2	Proposal Submitted By (Please use legal name) Full First Name, Middle, Last David H. Pan		Employee No.	
	Organization (Unit/Div/Dept/Section) XR&T/WCR&T	Electronic Mail Address Dpan@crt.xerox.com	Bldg. No./Mail Stop W114-23D	Extension 8*222-8969
3	Proposal Submitted By (Please use legal name) Full First Name, Middle, Last Chieh-Min Cheng		Employee No.	
	Organization (Unit/Div/Dept/Section) CSS/SD&MS/TDD&M	Electronic Mail Address Chieh-min.Cheng@sdms.usa.xerox.com	Bldg. No./Mail Stop W143-02S	Extension 8*222-6094
*4	Proposal Submitted By (Please use legal name) Full First Name, Middle, Last Adam Bush (contract)		Employee No.	
	Organization (Unit/Div/Dept/Section) CSS/SD&MS/TSS	Electronic Mail Address Adam.Bush@usa.xerox.com	Bldg. No./Mail Stop W139-64A	Extension 8*225-5633

*** If space for additional submitters is required, please use another sheet ; and attach any supplementary Comments.**

Mangers	Electronic Mail Address
Daniel G. Marsh (139-65B) / Kathy O'Brien (143-02S) / Santokh Badesha (114-39A)	Daniel.Marsh@usa.xerox.com

Descriptive Title of Proposal:

Photoresist Spacer Layer in Electronic Paper Application

Provide a brief summary or abstract of the invention, specifically pointing out the feature that you think is new:

This Invention Proposal suggests a thin film device (electronic page) with a photoresist spacer layer that can display an image under an electric field using LID, CEP, and lithography technology.

Provide here, using added pages, a more detailed technical description of your invention, including the advantage(s), and the problem(s) solved by the invention, and how each is accomplished. Please indicate the current methods or techniques used to solve the problem(s), and the deficiencies of these methods or techniques. Sketches, drawings, notebook pages, memos, or photos can be very helpful and should be attached if possible:

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Approach

As mentioned in the previous IP/ , the electronic paper design can be achieved using LID (Liquid Ink Development) and CEP (Contact Electrostatic Printing) technology. LID is charged liquid toner dispersed in hydrocarbon fluid such as Isopar. The toner concentration is around 2% and the toner is developed under electrical field of about 1 volt per micron gap. The idea is to prepare a liquid toner containing two types of toner particles with opposite charge and visual contrast color.

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Submitter(s) Signature(s)	Date

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The photoresist layer is laminated onto the conductive metal layer surface and masked. After exposure to ultraviolet light, the mask is removed and the photoresist is etched accordingly (Figure 1). After filling the holes etched in the photoresist layer with the desired ink system, an adhesive is applied to the upper ITO coated PET film layer and placed on top of the spacer layer. The three layers are then sandwiched together to form the final electronic paper construction (figure 2).

Figure 1. The photoresist layer is laminated, masked and etched on a metal layer.

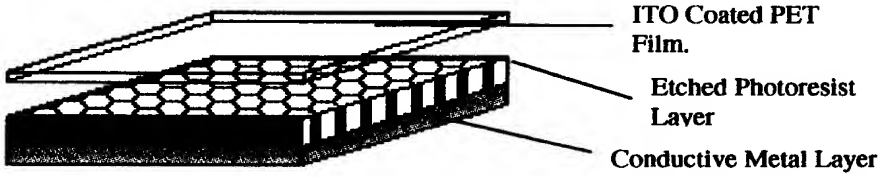
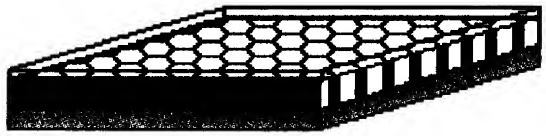


Figure 2. Final Sandwich Structure With Etched Photoresist as Spacer Layer.



As shown in Figure 3, the liquid toner can be placed or printed into the reservoirs, which are 50-200 micron holes in the spacer film, and then glued down to the substrate. The substrate is a transparent, conductive plastic film, such as PET coated with indium tin oxide (ITO). Finally, sealing the top with another conductive PET film completes the multi-layered electronic paper design.

Figure 3 shows that the top surface appears white since all colored toner particles are hidden behind the white particles. Figure 4 shows the colored liquid toner moves to the top surface, and thus the color image appears. The conductive path on the bottom substrate can be patterned so that the electric field on each reservoir can be controlled individually.

Witnessed and Understood By	Date
Submitter(s) Signature(s)	Date

IP

Figure 3. The film under positive electrical field (off position)

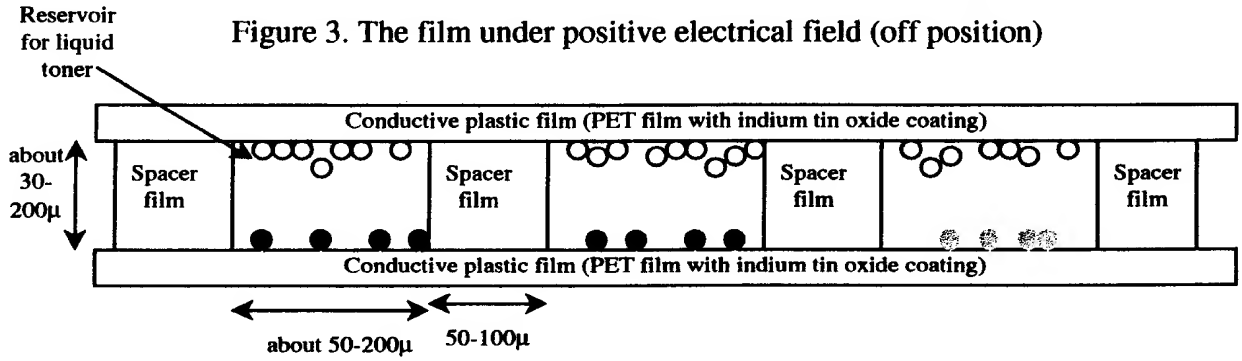
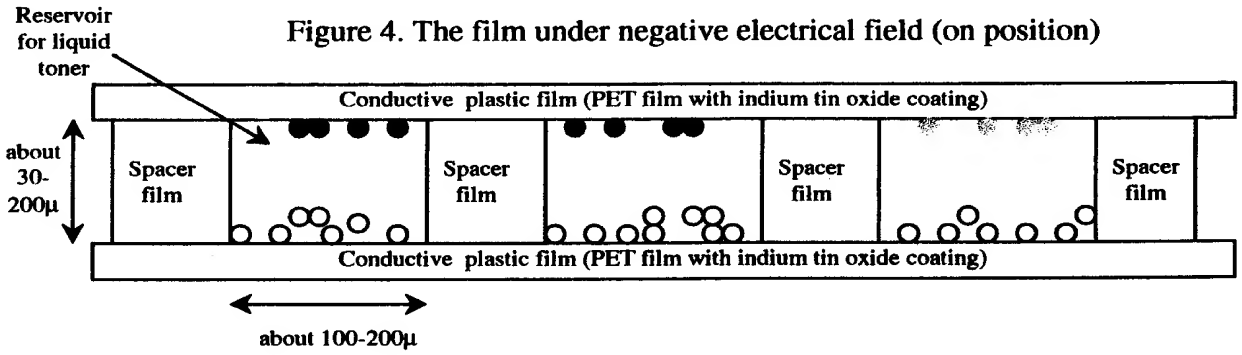


Figure 4. The film under negative electrical field (on position)



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Submitter(s) Signature(s)	Date

Form 53136 ( ) LEG

Names of others known to have worked on this or similar invention:
Not Known

Identify any known similar, or related invention proposals, patents or publications. Xerox or non-Xerox commercial products, or indicate none: :

Has a model, a prototype, or experiment of the invention been built, made, run, or tested?	**Yes**	**No**	**X**
Is the invention used in a current product(s) or planned for use in a future product(s)?	**Yes**	**No**	

If so, please identify the program(s) or product(s), and introduction dates

Indicate the date(s) of any previous or planned future disclosure external to Xerox, (has the invention been disclosed, or is it planned or disclosure outside of Xerox) and identify the type of disclosures (by agreement, demonstration, paper or presentation given, market probe, published article, etc. and if convenient , please provide a copy of the agreement, paper or article):
No

Source of outside funding, if any:
NONE

Witnessed and Understood By	Date
Submitter(s) Signature(s)	Date

EXHIBIT D

XEROX Invention Proposal

XEROX Private Data

IP

To: Xerox Intellectual Property Department

[X] Xerox Square - 020A, Rochester, NY, 14644, Mail Stop XRX2-20A

[ ] El Segundo, CA, 101 Continental Blvd.. 90245, Mail Stop: ESC1-801

[ ] Palo Alto, CA, 3333 Coyote Hill Road 94304, Mail Stop: PARC

(Send Original to the Intellectual Property Department and a copy to your Manager.)

1	Proposal Submitted By (Please use legal name) Full First Name, Middle, Last: Pinyen Lin SPL		Employee No.	
	Organization (Unit/Div/Dept/Section): CSS/SD&MS/TDD&M	Electronic Mail Address: Pinyen_Lin@wb.xerox.com	Bldg. No./Mail Stop: W139-65B	Extension: 8*225-7382
2	Proposal Submitted By (Please use legal name) Full First Name, Middle, Last: David H. Pan MHP		Employee No.	
	Organization (Unit/Div/Dept/Section): XR&T/WCR&T	Electronic Mail Address: Dpan@crt.xerox.com	Bldg. No./Mail Stop: W114-23D	Extension: 8*222-8969
3	Proposal Submitted By (Please use legal name) Full First Name, Middle, Last: Chieh-Min Cheng		Employee No.	
	Organization (Unit/Div/Dept/Section): CSS/SD&MS/TDD&M	Electronic Mail Address: Chieh-min.Cheng@sdms.usa.xerox.com	Bldg. No./Mail Stop: W143-02S	Extension: 8*222-6094
*4	Proposal Submitted By (Please use legal name) Full First Name, Middle, Last: Adam Bush (contract)		Employee No.	
	Organization (Unit/Div/Dept/Section): CSS/SD&MS/TSS	Electronic Mail Address: Adam.Bush@usa.xerox.com	Bldg. No./Mail Stop: W139-64A	Extension: 8*225-5633

*** If space for additional submitters is required, please use another sheet ; and attach any supplementary Comments.**

Mangers: Daniel G. Marsh (139-65B) / Kathy O'Brien (143-02S) / Santokh Badesha (114-39A) — Electronic Mail Address: Daniel.Marsh@usa.xerox.com

Descriptive Title of Proposal:

Composite Photoresist Spacer Layer in Electronic Paper Application

Provide a brief summary or abstract of the invention, specifically pointing out the feature that you think is new:

This Invention Proposal suggests a thin film device (electronic page) with a composite photoresist spacer layer that can display an image under an electric field using LID, CEP, and lithography technology.

Provide here, using added pages, a more detailed technical description of your invention, including the advantage(s), and the problem(s) solved by the invention, and how each is accomplished. Please indicate the current methods or techniques used to solve the problem(s), and the deficiencies of these methods or techniques. Sketches, drawings, notebook pages, memos, or photos can be very helpful and should be attached if possible:

More than 120 CEOs and other corporate executives all over the world went to Seattle for Microsoft's annual CEO Summit meeting. In the keynote speech, Microsoft CEO Bill Gates outlined his vision for how business leaders can use the Digital Nervous System. One of the things Gates mentioned was the E-book. "It will probably be 5 to 10 years before we have the screens that have the right weight and the right resolution before that happens. But, the key point is, that it is going to happen." Gates said.

Approach

As mentioned in the previous IP/ , the electronic paper design can be achieved using LID (Liquid Ink Development) and CEP (Contact Electrostatic Printing) technology. LID is charged liquid toner dispersed in hydrocarbon fluid such as Isopar. The toner concentration is around 2% and the toner is developed under electrical field of about 1 volt per micron gap. The idea is to prepare a liquid toner containing two types of toner particles with opposite charge and visual contrast color.

Witnessed and Understood By: Paula Bernhardt	Date
Submitter(s) Signature(s): David Pan Pinyen Lin	Date

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The first step in the manufacture of the etched spacer layer is to laminate the metal to be etched with photoresist film (figure 1). Once laminated, a mask is constructed in the form of the area where etching is not desired and placed over the laminate (figure 2). The layered system is then exposed to an ultraviolet light that alters the unmasked photoresist at the chemical level. Next, the mask is removed and the system is dipped into a solution that dissolves the chemically altered portions of the photoresist layer. This produces a photoresist layer that is identical in appearance to the mask (figure 3). Unlike the mask however, the photoresist layer is not sensitive to the acidic solution which etches the metal layer. Therefore, during the next step when the system is dipped into the acidic solution, the exposed metal is etched where no photoresist film is present and unaffected where photoresist film is present (figure 4). The final product is a spacer layer with a total thickness equal to the thickness of the metal and the upper and lower photoresist layers, containing holes with desired dimensions etched completely through the layer, and has strong support due to the presence of the middle metal layer.

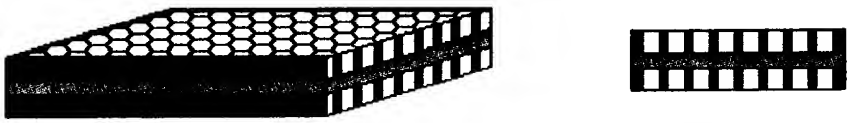
Figure 1. A thin metal sheet laminated on top and bottom with photoresist film.

Side View

Figure 2. Metal and photoresist layers with mask being applied to surface.

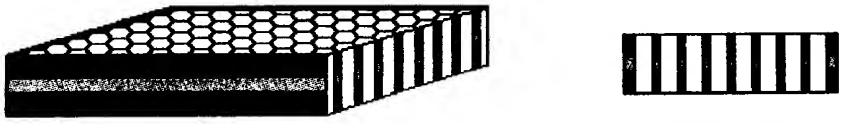
Side View

Figure 3. Metal layer with desired photoresist layer pattern.



Side View

Figure 4. Metal and photoresist layers with complete etching.



Side View

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As shown in Figure 5, the liquid toner can be placed or printed into the reservoirs, which are 50-200 micron holes in the spacer film, and then glued down to the substrate. The substrate is a transparent, conductive plastic film, such as PET coated with indium tin oxide (ITO). Finally, sealing the top with another conductive PET film completes the multi-layered electronic paper design.

Figure 5. The film under positive electrical field (off position)

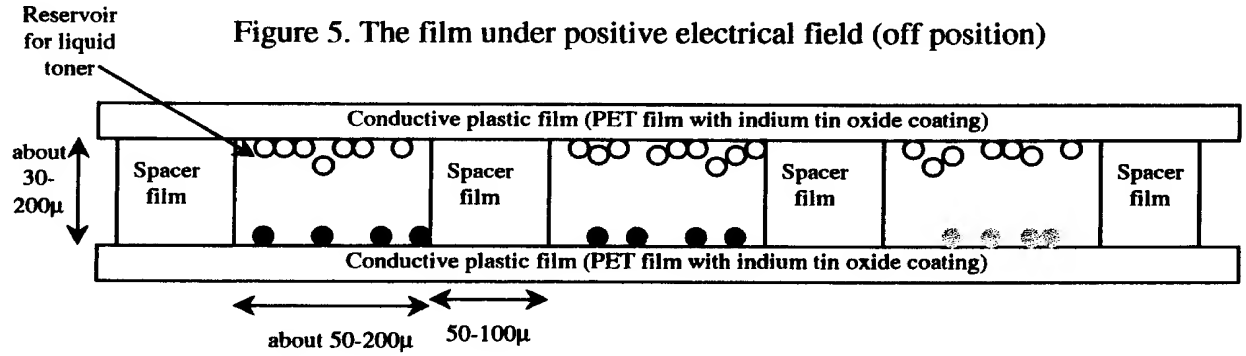

Figure 6. The film under negative electrical field (on position)

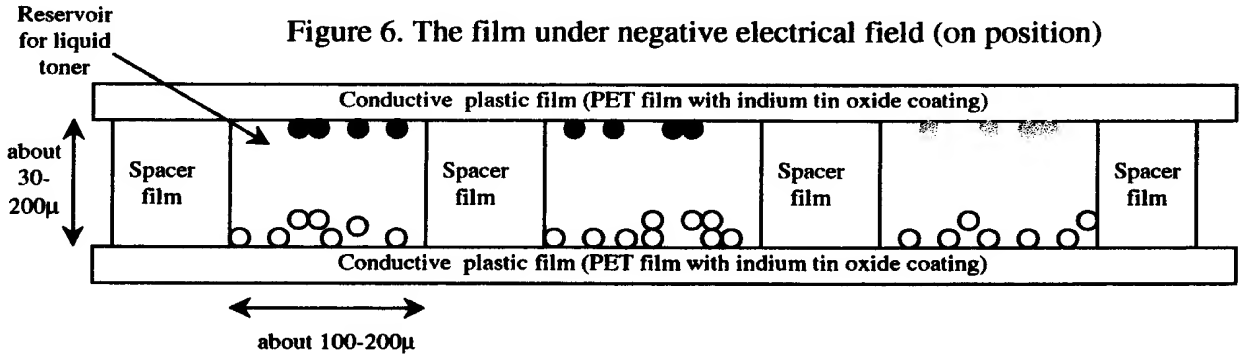

Figure 5 shows that the top surface appears white since all colored toner particles are hidden behind the white particles. Figure 6 shows the colored liquid toner moves to the top surface, and thus the color image appears. The conductive path on the bottom substrate can be patterned so that the electric field on each reservoir can be controlled individually.

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Names of others known to have worked on this or similar invention:
Not Known

Identify any known similar, or related invention proposals, patents or publications. Xerox or non-Xerox commercial products, or indicate none: :

Has a model, a prototype, or experiment of the invention been built, made, run, or tested?	**Yes**	**No**	**X**
Is the invention used in a current product(s) or planned for use in a future product(s)?	**Yes**	**No**	

If so, please identify the program(s) or product(s), and introduction dates

Indicate the date(s) of any previous or planned future disclosure external to Xerox, (has the invention been disclosed, or is it planned or disclosure outside of Xerox) and identify the type of disclosures (by agreement, demonstration, paper or presentation given, market probe, published article, etc. and if convenient , please provide a copy of the agreement, paper or article):
No

Source of outside funding, if any:
NONE

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EXHIBIT E

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1	Pinyen Lin (PYL)			
	Organization (Unit/Div/Dept/Section): CSS/SD&MS/TDD&M	Pinyen_Lin@wb.xerox.com	W139-65B	8*225-7382
2	David H. Pan (DHP)			
	Organization (Unit/Div/Dept/Section): XR&T/WCR&T	Dpan@crt.xerox.com	W114-23D	8*222-8969
3	Chieh-Min Cheng			
	Organization (Unit/Div/Dept/Section): CSS/SD&MS/TDD&M	Chieh-min.Cheng@sdms.usa.xerox.com	W143-02S	8*222-6094
4	Adam Bush (contract)			
	Organization (Unit/Div/Dept/Section): CSS/SD&MS/TSS	Adam.Bush@usa.xerox.com	W139-64A	8*225-5633
5	David E. Holden			
	Organization (Unit/Div/Dept/Section): IJBU/MMC	David.Holden@usa.xerox.com	201-08L	8*231-8544

*** If space for additional submitters is required, please use another sheet ; and attach any supplementary Comments.**

Mangers	Electronic Mail Address
Daniel G. Marsh (139-65B) / Kathy O'Brien (143-02S) / Santokh Badesha (114-39A)	Daniel.Marsh@usa.xerox.com

Descriptive Title of Proposal:

Liquid Toner-Filled Bubble Spacer Layer in Electronic Paper Application

Provide a brief summary or abstract of the invention, specifically pointing out the feature that you think is new:

This Invention Proposal suggests a thin film device (electronic page) with a liquid toner-filled bubble spacer layer that can display an image under an electric field using LID, CEP, and lithography technology.

Provide here, using added pages, a more detailed technical description of your invention, including the advantage(s), and the problem(s) solved by the invention, and how each is accomplished. Please indicate the current methods or techniques used to solve the problem(s), and the deficiencies of these methods or techniques. Sketches, drawings, notebook pages, memos, or photos can be very helpful and should be attached if possible:

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Witnessed and Understood By: Paulin Berkeveldt	Date
Submitter(s) Signature(s): David Pan, Pinyen Lin, David Holden	Date

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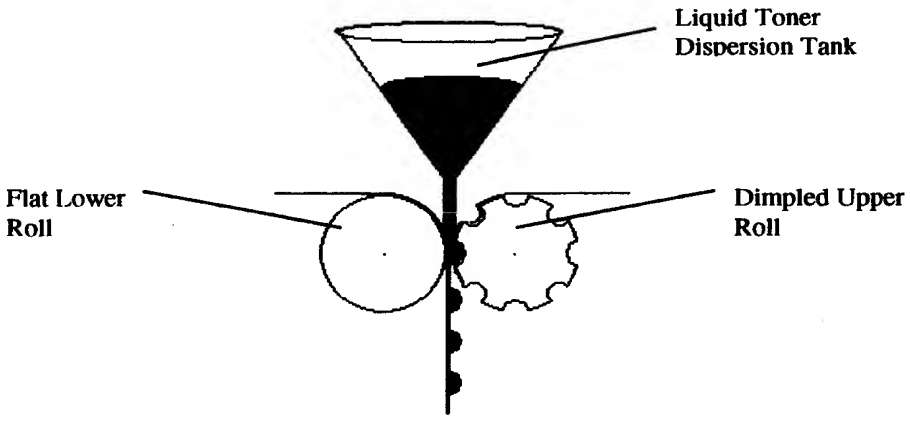
Approach

As mentioned in the previous IP/ , the electronic paper design can be achieved using LID (Liquid Ink Development) and CEP (Contact Electrostatic Printing) technology. LID is charged liquid toner dispersed in hydrocarbon fluid such as Isopar. The toner concentration is around 2% and the toner is developed under electrical field of about 1 volt per micron gap. The idea is to prepare a liquid toner containing two types of toner particles with opposite charge and visual contrast color.

One proposed idea for a potential electronic paper spacer layer is a thin film bilayer with liquid toner-filled bubbles. It is modeled after "Bubble Wrap" but with a manufacturing process modification of filling the air bubbles with liquid toner. As illustrated in figure 1, two rolls are positioned side by side that each feed a thin film layer toward a joining point where they will be adhered together. One roll is a flat surface that simply feeds the bottom film layer through the system. The other roll has dimples, which will create bubbles of a desired dimension on the upper film layer of the final product. Positioned over the rolls is a liquid toner dispersion tank that gravity feeds the fluid into the space between the adhering films. The final bubble will be formed by one or both of two mechanisms: 1) gravity will cause the liquid to expand the upper film layer into the dimples filling the small bubble pockets at the moment of adherence, or 2) the dimpled roll can provide a vacuum suction that will pull the upper film into the dimple while the bubble is filling and the layers are adhering. The final product will be a spacer layer with liquid toner-filled bubbles with a desired diameter, depth, and spacing as specified by the dimpled roll (figure 2).

Figure 1. Manufacturing Process of Ink-Filled Bubble Film.



As shown in Figure 3, the liquid toner can be placed or printed into the bubbles, which are the 50-200 micron separations between the bilayer spacer film, and then glued down to the substrate. The substrate is a transparent, conductive plastic film, such as PET coated with indium tin oxide (ITO). Finally, sealing the top with another conductive PET film completes the multi-layered electronic paper design.

Witnessed and Understood By	Date
Submitter(s) Signature(s)	Date

Figure 3 shows that the top surface appears white since all colored toner particles are hidden behind the white particles. Figure 4 shows the colored liquid toner moves to the top surface, and thus the color image appears. The conductive path on the bottom substrate can be patterned so that the electric field on each reservoir can be controlled individually.

Figure 2. Final Liquid Toner-Filled Electronic Paper Spacer Layer.

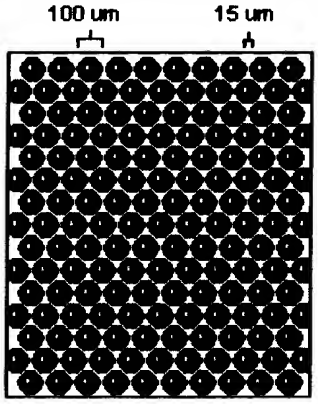


Figure 3. The film under positive electrical field (off position)

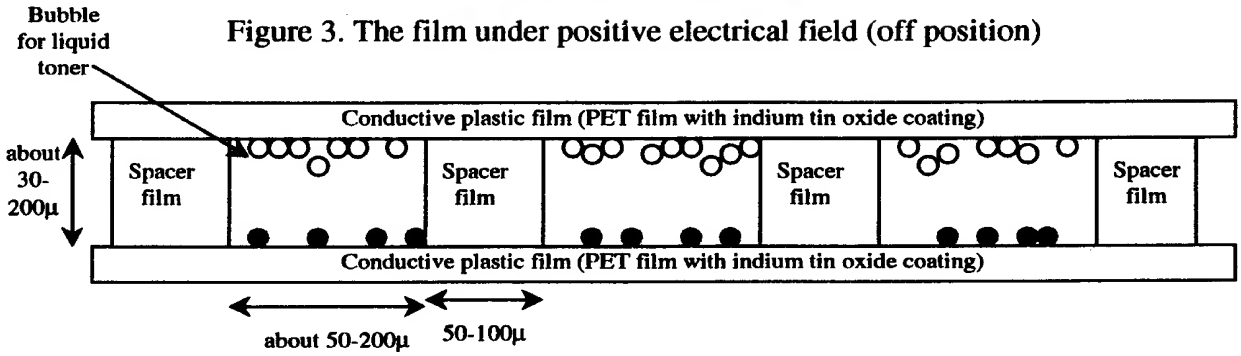
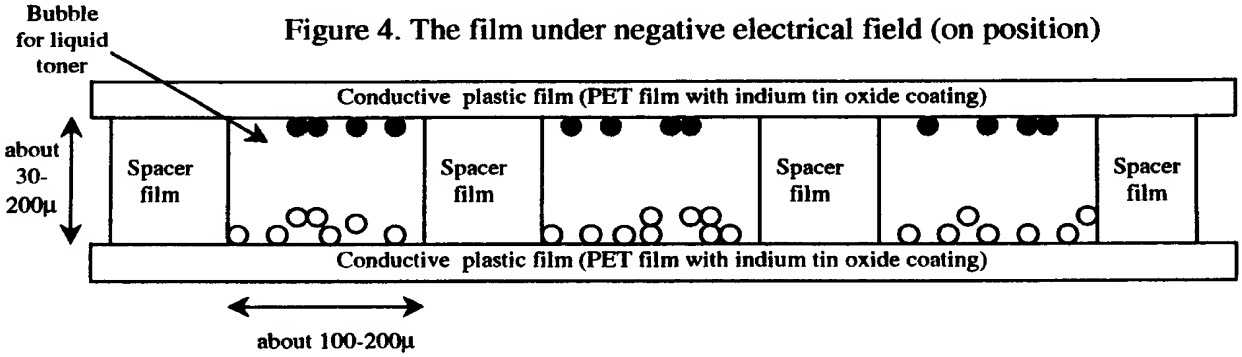


Figure 4. The film under negative electrical field (on position)



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Names of others known to have worked on this or similar invention:
Not Known

Identify any known similar, or related invention proposals, patents or publications. Xerox or non-Xerox commercial products, or indicate none: :

Has a model, a prototype, or experiment of the invention been built, made, run, or tested?	**Yes**	**No** X
Is the invention used in a current product(s) or planned for use in a future product(s)?	**Yes**	**No**

If so, please identify the program(s) or product(s), and introduction dates

Indicate the date(s) of any previous or planned future disclosure external to Xerox, (has the invention been disclosed, or is it planned or disclosure outside of Xerox) and identify the type of disclosures (by agreement, demonstration, paper or presentation given, market probe, published article, etc. and if convenient , please provide a copy of the agreement, paper or article):
No

Source of outside funding, if any:
NONE

Witnessed and Understood By [signature] Date

Submitter(s) Signature(s) Date

[signature] [signature] [signature] [signature]

EXHIBIT F

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1	Pinyen Lin SPL			
	Organization (Unit/Div/Dept/Section)	Electronic Mail Address	Bldg. No./Mail Stop	Extension
	CSS/SD&MS/TDD&M	Pinyen_Lin@wb.xerox.com	W139-65B	8*225-7382
2	Proposal Submitted By (Please use legal name) Full First Name, Middle, Last		Employee No.	
	David H. Pan MHS			
	Organization (Unit/Div/Dept/Section)	Electronic Mail Address	Bldg. No./Mail Stop	Extension
	XR&T/WCR&T	Dpan@crt.xerox.com	W114-23D	8*222-8969
3	Proposal Submitted By (Please use legal name) Full First Name, Middle, Last		Employee No.	
	Chieh-Min Cheng			
	Organization (Unit/Div/Dept/Section)	Electronic Mail Address	Bldg. No./Mail Stop	Extension
	CSS/SD&MS/TDD&M	Chieh-min.Cheng@sdms.usa.xerox.com	W143-02S	8*222-6094
4	Proposal Submitted By (Please use legal name) Full First Name, Middle, Last		Employee No.	
	Adam R Bush (contract)			
	Organization (Unit/Div/Dept/Section)	Electronic Mail Address	Bldg. No./Mail Stop	Extension
	CSS/SD&MS/TSS	Adam.Bush@usa.xerox.com	W139-64A	8*225-5633
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Descriptive Title of Proposal:

Liquid Toner-Filled, Multiple Colored Bubble Spacer Layer in Electronic Paper Application

Provide a brief summary or abstract of the invention, specifically pointing out the feature that you think is new:

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Witnessed and Understood By	Date
Paula Bernhardt	
Submitter(s) Signature(s)	Date
David Pan Pinyen Lin David Holden	

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Two different colored liquid toner spacer layers can be manufactured with large gaps between bubbles (figure 2a). By creating a dimpled roll with the desired bubble pattern, as explained above, a spacer layer with large gaps can be produced. By filling two separate spacers with different colors, inverting one of them, and placing it on top of the first, a single multi-colored spacer layer can be constructed (figure 2b). This can be a very helpful tool in creating color applications later in the development of electronic paper.

Figure 1. Manufacturing Process of Ink-Filled Bubble Film.

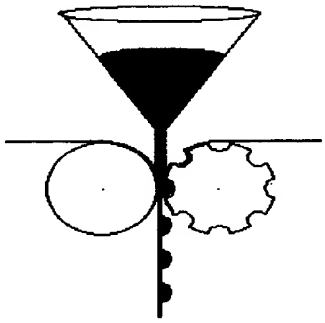
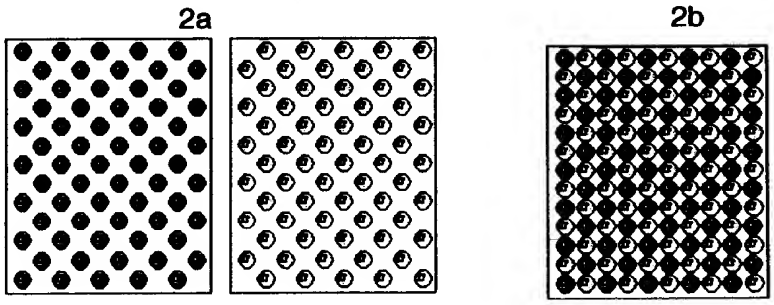


Figure 2. a) Two different colored liquid toner spacer layers with gaps between bubbles. b). Inverting one colored spacer and placing it on top of the other yields a single multi-colored spacer layer useful in color applications.



Witnessed and Understood By Paula Bernhardt	Date
Submitter(s) Signature(s) David Pan Ping Li	Date

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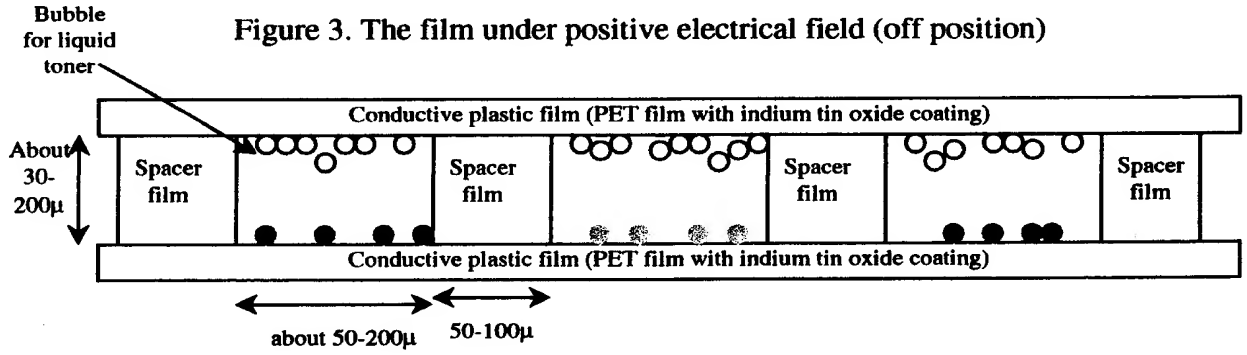

Figure 3. The film under positive electrical field (off position)

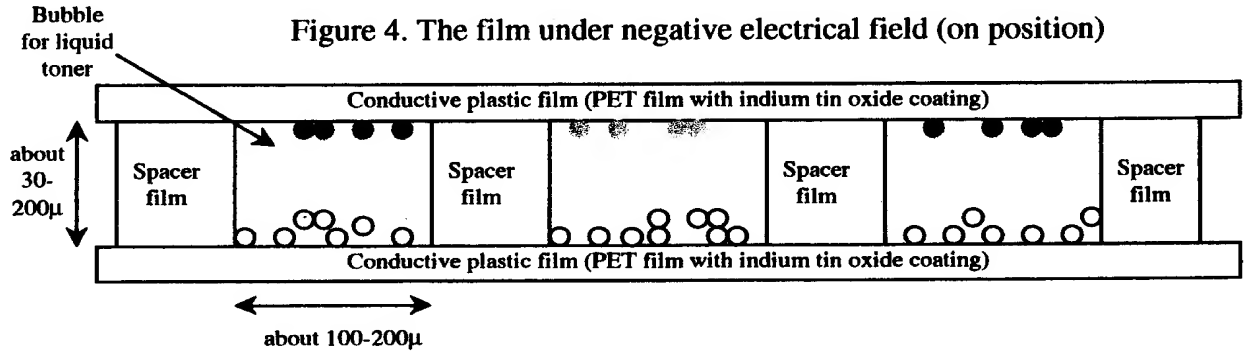

Figure 4. The film under negative electrical field (on position)

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